RETRO-REFLECTIVE AIMING MEANS

Field of the Invention

The present invention relates to aiming means for fire arms. More particularly, this invention relates to method and device for providing an instinctive and rapid procedure for accurately aiming fire arms at a given target.

Background of the Invention

Conventional methods for aiming at a target require aiming means that comprise rear and front sights, normally situated on top of the barrel of the firearm. Such means, which are described, for example in USP 5,933,972; USP 6,216,351; USP 5,992,030, and USP 5,956,854, are enhanced solutions for firearm means, based on the basic idea of aligning both the rear and front sights with line of sight of the shooter with the target, in order to hit the target more accurately. However, in all the methods, based on rear and front sights, the shooter is required to align these two elements in order to hit the target. This procedure is based on his judgment on whether the two elements are perfectly aligned, or imperfectly so. Such judgment of the perfection of the shooter's act requires an indispensable time from said shooter, which may result in missing the opportunity to shoot first.

USP 6,604,315 B1 discloses an aiming apparatus which comprises a first and a second lenticular element, orthogonal to each another, both mounted on the barrel of the gun, wherein the first lenticular element receives a first image when the shooter's aiming eye is in proper alignment with said barrel in elevation and a second image when the shooter's aiming eye is not in proper alignment in elevation, and the second lenticular element receives a third

image when the shooter's aiming eye is in proper alignment with said barrel in azimuth and a fourth image when the shooter's aiming eye is not in proper alignment in azimuth. However, this apparatus is not satisfactory, firstly because it comprises two lenticular elements and is therefore somewhat complicated and costly; secondly, because a shooter using it, has to rely on the accurate perception of colors that may not be quite distinctive to him.

While using handguns, such as pistols and revolvers, a rapid aiming procedure is sometimes needed, as the time factor might be deadly crucial. Such is the case in a battlefield, wherein hitting the target with high accuracy is less important than shortening the time until a bullet is shot toward the target with a reasonable level of accuracy.

It is therefore the object of the present invention to provide with aiming means that shorten the procedure of aiming the firearm, while still keeping to a reasonable extent the accuracy of effectively hitting the target.

It is another purpose of this invention to provide an add-on aiming device, which can be mounted on a firearm, in addition to its original sight, whereby the shooter may choose between the two instinctive aiming means in each particular case.

It is another purpose of this invention to provide an aiming device for guns, particularly, but not exclusively, hand-held short range guns, for instance pistols and revolvers, which consists of a single structural element and concurrently permits to aim precisely at the target point and to determine when the gun barrel is properly oriented.

It is another purpose of this invention to provide an aiming device that allows even an unskilled shooter to substantially eliminate subjective errors while aiming to a target.

Other purposes and advantages of the invention will appear as the description proceeds.

Summary of the Invention

The present invention is directed to an aiming device for guns, such as firearms, toy guns, PaintBall guns and any gun that is intended to shoot a real, dummy or virtual projectile of any shape to a target.

The aiming device comprises a retro reflective lenticular component, which is seen by the shooter as having a first color, such as a bright color, when the aim line has a desired orientation and having a second color, or no color, when the aim line does not have that desired orientation. Preferably, the aim line has the desired orientation when it is parallel to the gun barrel axis. Alternatively, the aim line may have the desired orientation when it has a predetermined slant to the gun barrel axis.

By using the term "retro reflective lenticular component", it is meant to include any essentially transparent optical lens, which is capable of collecting light emission, incoming from a given angle of incidence, and reflecting the collected light back in the same angle, and/or diffracting at least a portion of any collected light to any desired direction, such that most of the reflected and/or the diffracted light, or at least a portion thereof, is redirected to any desired direction.

Preferably, the optical component of the aiming device comprises a retro reflective lenticular element, e.g., a lens that comprises two opposite convex walls, such that one of the walls is capable of concentrating incoming parallel light beams upon the other wall. One of the walls may be tinted with two or more different colors. One of the colors may be located at the center of the wall, and the other color covers the peripheral area. Alternatively, the retro reflective element may comprise a convex lens and a parallel wall portion, located at the focal point of the lens and tinted with at least two different colors. The colors may be phosphorus, fluorescent materials, and radioactive luminous materials, such as Tritium.

The retro reflective lenticular element may further comprise a fully or partially reflective surface, which may be planar and symmetric with respect to and perpendicular to the axis of the cylindrical lens, or convex, with a tangent that is perpendicular to the axis of the cylindrical lens at the point of the surface at which the axis intersects the surface. The distal surface of the cylindrical lens may comprise at least two differently colored fully reflective surfaces.

The fully reflective surfaces may be so shaped as to indicate deviations in different directions.

The aiming device proposed by the present invention may be an add-on element that further comprises means for attaching it to a firearm when desired, without concealing the existing sights of the gun, so as to allow the shooter to use it alternatively or complementarily with the original aiming sights of the firearm.

The colors may be printed on an electroluminescent layer that is illuminated electrically by a battery that preferably comprises a photoelectric switch that is in its non-conductive state, as long as the gun is in its sheath. The aiming device may be disposable.

The aiming device may comprise:

a retroreflective lens, assembled at the proximal end of the aiming device an positioned, such that its central axis is essentially parallel to the central axis of the barrel of the firearm;

a light source assembled at the distal end of the aiming device, for emitting light beams toward the central axis of the lens;

a first light gathering rod, assembled following to the lens for collecting ambient light during daytime, and light emitted from the light source during nighttime, and for and reflecting and/or diffracting the collected light as beams of the first tint, toward the proximal end of the lens, essentially in parallel to its central axis; and

a second light gathering or a transparent rod, assembled co-linearly within the first light gathering rod and having a second tint, for collecting ambient light during daytime, and light emitted from the light source during nighttime, and for reflecting and/or diffracting the collected light as beams of the second tint, toward the proximal end of the lens, essentially along, and in the vicinity of, its central axis. The first tint is seen by the shooter as occupying most of the projection of the lens, when the aim line has a desired orientation. The second tint is seen by the shooter as occupying most of the projection of the lens, when the aim line does not have the desired orientation.

Brief Description of the Drawings

- Fig 1 describes a pistol and an aiming sight mounted on its barrel shield, according to a preferred embodiment of the invention;
- Fig. 2A and 2B are enlarged vertical cross sections through the barrel shield and the aiming sight of the pistol described in Fig. 1, respectively;
- Fig. 3 demonstrates the alignment principle of the aiming sight relatively to the target;
- Fig. 4 describes an add-on version of the aiming sight, according to the invention;
- Figs. 5A and 5B is another embodiments of an aiming sight, with natural and electric illumination, according to the invention;
- Figs. 5C is another embodiments of an aiming sight, with natural and artificial illumination, according to the invention;
- and
- Figs. 6A and 6B are vertical views of the lens of Fig. 2 seen from the viewpoint of the gun shooter, when the gun is not properly aimed and when it is properly aimed, respectively.

Detailed Description of Preferred Embodiments.

Fig. 1 describes a pistol 1 having a single aiming sight 2 that according a preferred embodiment of the invention, is mounted onto its barrel shield 3. Aiming sight 2 consists of a retro reflective element 4 for providing the shooter an optical indication when the pistol has a desired orientation with respect to a target, and a base element 5, used for mounting it onto barrel shield 3. Such mounting may be achieved, for example, by inserting the base element 5 into a mating groove 37, formed in the barrel shield 3, as shown on Fig. 2A, or by any other securing means. The retro reflective element 4 is

essentially elongated structure, and is so mounted, such that its central axis is parallel to the barrel's axis.

The general principles and operation of retro reflective lenticular elements are described, e.g., in WO 98/00737, the contents of which are incorporated herein by reference. Such retro reflective lenticular element may comprise two opposite convex walls, where one of the walls can concentrate incoming parallel light beams upon the other wall. However, it will be understood that different structures can be designed by persons skilled in the optical art, particularly more complicated structures comprising a plurality of optical components.

Fig. 2B is a vertical cross section through aiming sight 2 and barrel shield 3 of pistol 1. Retro reflective element 4 is a double curved transparent cylinder; wherein the focal point of its rear curved face 6 falls on its front curved face 7. Front curved face 7 is painted with two different colors; one of them, for example, a green color, covers the central portion 8 of the front curved face 7 and the other one, for example a red color, covers its peripheral portion 9.

Incoming light rays, illustrated by dashed lines 10, are reflected to the viewer, if his line of sight is perfectly parallel to barrel shield 3, e.g. he sees the whole rear face 6, shining with a green color, which is a reflection of the central portion 8. An observer whose line of sight, marked with doted lines 11, is not parallel to barrel shield 3, will see red color, which is a partial reflection of the peripheral portion 9.

Fig 3 better illustrates the above-mentioned disposition. If human eye 12, the central line of the retro reflective element 4, and the center of the target 13,

are positioned along a straight line, the observer sees a green spot, belonging to aiming sight 2, in the midst of target 13. If the central line of barrel 3 and the axis of aiming sight 4 are perfectly parallel, projectile 14 will hit target 13, about 20 mm below its center (which is the distance between these parallel lines, in this example). This deviation from the center of target 13 is meaningless, when the shooter whishes to effectively hit relatively large targets, such as the human body.

By using the aiming sight proposed by the present invention, shooters are exempt from considering, traditionally, whether the front and the rear sights are really aligned. Instead, a sufficient level of accuracy is easily obtained when the shooter is only required to verify that a green light spot is clearly displayed to his eye. This procedure is therefore faster and easier for even an unskilled shooter who wishes to hit a target almost instinctively. One of the main advantages of the aiming sight proposed by the present invention is the magnification effect of the spot. This effect causes a sharp transition between the singular state, when the firearm is properly aimed (i.e., has a desired orientation with respect to the target), and all other states, when the firearm is not properly aimed. In case where the cross-section of the lens is essentially symmetrical (e.g., circular), when the firearm is not properly aimed, such a sharp transition is obtained due to deflection from said singular state, ***in any direction***. Therefore, switching between states is reflected to the eye of the shooter as switching between colors. Escalating magnification results in escalating sharpness, which helps the shooter reaching and maintaining the desired singular state, until the projectile is shot toward the target.

Colors of frontal face 7, especially central area 8, of retro reflective element 4, can be filled with fluorescent or phosphorous colors, preferably with Tritium, which radioactively illuminates even at any dark environmental conditions. Thus, an excellent night sight is created, which is easy to identify instantaneously.

According a preferred embodiment of the invention, front face 7 may comprise more than two colors, at once; for example, a green one at the center, orange at its close periphery, and red color on the rest of it. Thus, a more efficient arrangement is created, facilitating the aiming procedure for less skilled shooters that are not well accustomed to immediately finding the perfect orientation.

According a preferred embodiment of the invention, another efficient coloring of the retro reflective element can be achieved when the coloring combination provides the shooter indications regarding horizontal and/or vertical deviations from perfect alignment. Other coloring combinations are also possible for providing indications regarding deviations in other directions, according to special needs.

Retro reflective element 4 is rather simple and easy to produce. Nevertheless, other retro reflective arrangements are possible, as well.

Fig. 5A describes a tiny double curved lens 17, situated in front of a vertical colored wall portion 18. If wall portion 18 is spaced apart from lens 17, in a distance substantially equal to its focal length, colored spot 19, aligned with the center of lens 17, will be fully displayed to the eye of the shooter, according to the same principle, described with respect to Fig. 2 above.

Fig. 5B describes an aiming sight similar to the aiming sight of Fig. 5A (using natural illumination of the environment), but with electric illumination. The lens 17 is inserted into a metal cylindrical mounting sleeve 50 that has a base element similar to base element 5 shown in Fig. 2A above, which is inserted into the mating groove 37, formed in the barrel shield 3, as also shown in Fig. 2A. An electroluminescent layer 57 is also inserted into the sleeve 50, such that it essentially attached to the distal (less curved) wall of lens 17 (electroluminescent technology is disclosed, for example, in U.S. Patent Applications Nos. 2004-017153, 2004-023591 and USP 6,690,118 of Sanyo Electric Corporation, Japan). Electroluminescent layer 57 comprises two printed transparent colors, a green spot 59 and a red background 58, surrounding that spot and has two metal spring electrical contacts 56. A cylindrical battery 54 having additional metal spring electrical contact 56, is also inserted into the sleeve 50 and a plastic cover 51 seals the distal end of sleeve 50, such that all contacts 56 are depressed. Cover 51 comprises a commonly used photoelectric switch die 52, which is mounted close to its edge and a plated conductive layer 55. Two electrical wires 53, formed within cover 51 connect the conductive layer 55 and the additional metal spring electrical contact 56 to the two contacts of the photoelectric switch die 52. When all contacts 56 are depressed, the upper contact 56 touches sleeve 50, the lower contact 56 touches the positive contact of battery 54, the additional contact 56 touches the negative contact of battery 54 and layer 55 touches sleeve 50, as well.

As long as the gun is in its sheath, switch die 52 is not exposed to sufficient amount of light, and therefore, switch die 52 will remain in its morally non-conductive state. Consequently, no power will be consumed from battery 54

by layer 58. When the gun is drawn out from its sheath, switch die 52 is exposed to the background light (shown in solid arrows), and therefore, switch die 52 will switch to its conductive state. Consequently, battery 54 will provide power to layer 58, such that spot 59 and red background 58 are sufficiently illuminated, so as to allow the shooter to clearly view the reflection of spot 59, when the gun is perfectly aligned.

Of course, other arrangements for providing the required illumination may be used by any person skilled in the art, including a low cost disposable aiming sight, with or without a photoelectric switch die 52, that is replaced whenever the battery 54 runs out of power.

Fig. 5C describes another implementation of an aiming sight, according to another embodiment of the invention. Lens 17 is a part of an arrangement 500 that is mounted by a metal cylindrical housing 501, having a base element, similar to base element 5 shown in Fig. 2A above, which is inserted into the mating groove 37, formed in the barrel shield 3, as also shown in Fig. 2A. The lens 17 is inserted into mounting sleeve 50 which is also a part of the arrangement. A fluorescent transparent cylinder 502 (which is a form of a light gathering rod), having an essentially green tint, follows lens 17, such that bulge 503 in the distal (less curved) wall of lens 17 and the first recess 504 in cylinder 502 mate. A thin fluorescent transparent cylindrical fiber 505 (which is also another form of a light gathering rod), having an essentially red tint, is inserted into cylinder 502, such that they are concentric. Cylinder 502 comprises a second recess 506, into which an illuminating ampoule 507 is inserted. Ampoule 507, which is held in place by housing 501, comprises a long life, self illuminating material, such as Tritium. The size of ampoule 507 is designed to emit light beams both into cylinder 502 and fiber 505.

During the daytime, light penetrates into housing 501 through an opening 508 in housing 501. Light beams that penetrate housing 501 and are perpendicular to its central axis also penetrate cylinder 502, thereby generating light beams that are parallel to said axis. The same light beams also penetrate cylinder 502, thereby generating light beams that are parallel to the central axis of fiber 505. Therefore, during the daytime, when the gun is not properly aimed (i.e., his line of sight is not parallel to the barrel's axis), the shooter sees a green circle at its center. When the gun is properly aimed, the shooter will see a red circle, which entirely colors the diameter of lens 17, as schematically indicated by gray shading in Fig. 6B. Both tints are well seen during the daytime, since both cylinder 502 and fiber 505 collect a great amount of light from their lateral surface and reflect it toward lens 17.

The light reflection mechanism is substantially changed during nighttime, when the source of light is ampoule 507. Light beams, emitted from the illuminating material, penetrate both through cylinder 502and fiber 505, along their central axes. Both red and green light beams reach lens 17, which reflects them toward the eye of the shooter, depending on the relation between his line of sight and the barrel's axis. Again, when the gun is not properly aimed (i.e., his line of sight is not parallel to the barrel's axis), the shooter sees a green circle at its center. When the gun is properly aimed, the shooter will see a red circle, which entirely colors the diameter of lens 17. Both tints are well seen during nighttime, since both cylinder 502 and fiber 505 collect a substantial amount of light from ampoule 507 and reflect it toward lens 17. Ampoule 507 can continuously illuminate at least 10 years, when Tritium is used as the radioactive illuminating material. In this example, lens 17 collects light emission, incoming from the direction of the

shooter's eye and reflects the collected light back to the same direction. In the same time, lens 17 collects light emission, incoming from cylinder 502 and fiber 505 and diffracts most of this collected light to the direction of the shooter's eye. This way, most of the light collected from the direction of the shooter's eye and from cylinder 502 and fiber 505 is redirected to the shooter's eye both by reflection and by diffraction.

It is, of course, clear to any person skilled in the art, that several different shapes can be used, rather than the circular shape, exemplified above. For example, the cross section of lens 17 may be a sector, a torus, or any other selected shape that can provide the shooter with strict distinguishable views between proper and improper alignment, depending on the design of the firearm. Moreover, the position of arrangement 500 along the barrel shield 3 may be any position, depending on the design of the firearm and the environmental requirements.

Figs. 6A and 6B are vertical views of the lens of Fig. 2B seen from the viewpoint of the gun shooter, illustrating said lens as it appears to the shooter. When the gun is not properly aimed, the shooter sees a colorless circle with a colored (red, in this example) dot at its center, as in Fig. 6A. When the gun is properly aimed, the shooter will see the lens as entirely colored, as schematically indicated by gray shading in Fig. 6B.

Alternative arrangements are also possible, such as using two magnifying lenses instead of one, in order to increase the accuracy of the sight, and so on. However, the embodiment described in Fig. 2 above seems to be simple and accurate enough for short-range firearms, such as pistols and revolvers.

The ideal place to install an aiming sight, according to the invention, is on the front part of the barrel; but it could be attached to any part of a firearm, as long as its central axis is essentially parallel to the trajectory of the bullet.

Firearms can be supplied with an aiming sight, according to the invention, originally installed in them. Nevertheless, for those who want to keep using the traditional rear sight 20 and front sight 16, an add-on version is provided, as shown in Fig. 4. A one-piece element that comprises two retro reflective elements 15 is adjusted to barrel 3, in a way that original front sight 16 is not overshadowed. Thus, a voluntary choice is provided to the shooter to alternatively choose the traditional aiming means, or the aiming sight proposed by the present invention, according to the given circumstances. Other add-on configurations can be provided as well, depending on the shape of a given firearm and the mission of its use.

In addition, the retro reflective lenticular element may include at least one fully reflective surface, such as a planar or curved mirror, in order to reflect light beams, incoming from a direction which is essentially parallel to the lenticular element's central axis. The fully reflective surface is symmetric with respect to and perpendicular to the axis of the cylindrical lens. The distal surface of the cylindrical lens comprises two fully reflective surfaces that are differently colored, so as to provide indications regarding deviations from perfect alignment in different directions.

It would be evident to those skilled in the art that the invention is not limited to the details of the foregoing illustrated embodiments and that the present invention may be embodied in other specific forms without departing from the spirit of the essential attributes thereof. For example, the aiming device

proposed by the present invention may be implements for guns that are not firearms, such at toy guns, PaintBall guns and any gun that is intended to shoot a real, dummy or virtual projectile of any shape to a target. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.